SECRET

STANDARD FORM NO. 64

Office Memorandum • UNITED STATES GOVERNMENT

TO : Asst. Director for Policy Coordination DATE: 7 June 1951
THRU : Chief, EE/OPC
FROM : Chief, Communications Division

SUBJECT: Technical Fitness of BG FIEND Installation

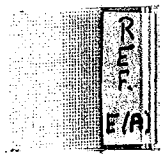
1. The many technical considerations related to the radio broadcasting facilities installed on BG FIEND were carefully studied by engineers of the Communications Division at the time the project was proposed. As then evaluated, the project was technically feasible providing broadcasts on medium frequencies were confined to darkness hours. An opportunity to judge the accuracy of this prediction was afforded during the vessel's shake-down last December. The measured field-strength over a 400 mile path confirmed the calculated values. By coincidence, the shake-down tests were made in near gale conditions off Cape Hatteras with heavy seas running, which did not reduce the effectiveness of the broadcasts.

2. A completely new study of the radio propagation factors applicable to BG FIEND was recently made by different engineers in view of disturbing cables from the field. These computations again agree with the earlier ones. The results of their study and excerpts from the radio log made during the shake-down cruise are attached for your information.

3. On the basis of the careful studies made by competent engineers, along with the confirming test transmissions, it can be seen that there are no technical radio factors which might limit the effectiveness of BG FIEND project as originally planned.

[illegible]

SECRET


REF.
E/A

STANDARD FORM NO. 64

SECRET

Office Memorandum • UNITED STATES GOVERNMENT

TO : Chief, Communications Division DATE: 6 June 1951

FROM : Chief, Engineering Branch

SUBJECT: BG FIEND Project

REFERENCE: [ ] (IN 43512), [ ] (IN 44704)

1. Paragraph 2A of [ ] (IN 43512) states that the recording equipment on board the BG FIEND vessel cannot be operated while the engines are operating. It is a fact that the recorders cannot be operated as recorders while the engines are in operation due to the background noise picked up by the microphones, but they can be used for playback purposes with no effect from the ship's engines. It is necessary to make all recordings with engines off or receive program material on tape from the base studio in Athens.

2. Paragraph 2B of [ ] (IN 43512) states that salt spray on the "hot antenna" cuts the medium wave transmitter off the air. Tests were conducted by Engineering Branch personnel on very rough seas with no difficulty experienced from salt spray. It is the understanding of all personnel in Washington that the transmitter has not been in operation since the above-mentioned tests, so it is felt that this statement is an assumption made only by visual inspection of the project.

3. Paragraph 2E of [ ] (IN 44704) states that use of the medium wave transmitter is restricted to operation while anchored in waters exposed directly to opposition and surveillance. This statement is, no doubt, based on utilization of the ground wave portion of the radiation pattern. It has been the understanding of the Engineering Branch from the original concept of this project that the target area was to be reached by the sky wave portion of the radiated signal. On the basis of this understanding, the following calculations were made:

a. With the transmitter located 200 miles from the target area, the critical vertical angle of radiation from the ship's antenna for maximum signal would be 33°. At 300 miles, the critical angle would be 23° and at 400 miles the critical angle would be 17°. The vertical component of the ship's antenna is approximately one-eight wavelength in the broadcast band. With no consideration for the horizontal component of the antenna, the radiated sky wave field intensity would exceed 150 millivolts per meter at one mile, at all above listed angles.

SECRET

b. Using 150 millivolts per meter as a conservative radiated field intensity figure at one mile, the following predictions were made for intensity at the target area.

With transmitter located 200 miles from target, the predicted field intensity at the target would be:

0.029 millivolts per meter for 95% of broadcast time
0.042 millivolts per meter for 90% of broadcast time
0.124 millivolts per meter for 50% of broadcast time
0.190 millivolts per meter for 30% of broadcast time

With transmitter located 300 miles from target, the predicted field intensity at the target would be:

0.024 millivolts per meter for 95% of broadcast time
0.036 millivolts per meter for 90% of broadcast time
0.112 millivolts per meter for 50% of broadcast time
0.180 millivolts per meter for 30% of broadcast time

With transmitter located 400 miles from target, the predicted field intensity at the target would be:

0.020 millivolts per meter for 95% of broadcast time
0.030 millivolts per meter for 90% of broadcast time
0.097 millivolts per meter for 50% of broadcast time
0.142 millivolts per meter for 30% of broadcast time

It can be concluded from the above figures that up to 400 miles from the target there is little decrease in signal strength. As the distance exceeds 400 miles between the transmitter and target area, the signal intensity will diminish as indicated by the trend of the above figures.

c. The average sensitivity of a poor grade AC/DC type receiver is about 0.03 millivolts per meter for full output, the average console type receiver has a sensitivity of about 0.01 millivolts per meter for full output and the average communications type receiver has a sensitivity of about 0.003 millivolts per meter for full output. It is therefore evident that with the listener using a very poor grade receiver, the signal would be sufficient to produce full output 90% of the broadcast time, with the transmitter operating at a distance up to 400 miles. It is more important to search for channels with least interference than to attempt to get closer to target area.

4. All predictions are based on Federal Communications Commission Standards of Good Engineering Practice covering standard broadcast stations.

It must be emphasized that the above predicted field strengths in the target area are based exclusively upon sky wave modes of transmission during the period from two hours after sunset to two hours before sunrise.

5. Attached is a copy of the report on tests made by Engineering personnel during the trip from Baltimore to Miami aboard the vessel. It should be noted that this cruise was made immediately after the installation of the yacht's radio equipment and was made as both a "shake-down" and an operational test. Conditions on the night of 17 December largely duplicate the radio propagation factors to be expected in the operating area except that the heavy seas encountered off Cape Hatteras probably exceed any which may be experienced in the Mediterranean. It may be recalled that the broken insulator which prohibited transmissions on the 15th was damaged from being struck by a securing line. Salt spray and heavy seas at no time handicapped the radiation efficiency of the installation.

FOR THE CHIEF, ENGINEERING BRANCH:

[redacted]

[redacted]

ATTACHMENT


REF
E(B)

CONTACTS WITH FIEND

12 December. Made first contact with Boat at 1630 on 80 meters. Made additional schedule for 2230. On 2230 schedule was informed that Boat did not wish to test broadcast transmitter because of location. Conditions good both ways and next schedule set for 1630 on 13 Dec.

13 December. Contact with difficulty at 1630. Next schedule set for 0230 on 14 Dec.

14 December. Contact at 0230 but equipment not ready for test yet. Good conditions on 1630 contact. Test laid on the following morning at 0230.

15 December. Contact at 0230 but unable to test broadcast transmitter because of broken bowl insulator on lead in (approximate position at this time was 250 miles from Washington Airline.) Extreme high wind and stormy weather prevented repairs being made in the dark. Next schedule 1630. At 1630 conditions were excellent and a test schedule set for 0230 on 16 Dec.

16 December. No contact was made at all on the morning of the 16. It was later learned through a ship-shore telephone call (from a point 70 miles southeast of Cape Lookout) and on the 1630 contact that very rough weather and the sickness of the chief operator prevented the Boat being on the air at all. The 1630 contact was sent blind from the Boat as the operator's receiver was out of order (burned out choke). During this blind transmission another schedule was made for 0230 on the morning of 17 Dec.

17 December. At 0230 contact was again made on 80 meters, and test of broadcast transmitter commenced at 0320 consisting of 5-minute transmissions on each of 4 courses: due south, east, north, and west. The signal strength was matched during these transmissions and found to be in the vicinity of 0.150 millivolts per meter in each case with no noticeable variation as a result of change in course. Considerable fading was of course observed, a normal condition for transmission over these distances and at this time of the morning. During the first transmission period modulation was inadvertently applied at a level much in excess of 100% because of failure to turn on the modulation monitor. This resulted in blowing out the main fuse of the power line. After replacement of the fuses, modulation was applied at levels of 75 to 80%. During the time of over-modulation, the signal from the Boat completely blanketed the test channel and was louder than and appeared equally strong (due to receiver AVC among other things) as a 50 kw channel 10 kc away. The position of the Boat at this time was 430 miles from Washington, and no trouble was

encountered in separating their signal from that of the aforementioned clear channel station as long as the receiver selectivity was set for 8 kc. bandwidth. An estimated time of arrival at Miami was given as the afternoon of the 19. New schedules were made for 1630 on the 17 and 2230 if the first schedule did not turn out to be effective.